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A new device permits the sampling of postlarval shrimp in the passes in which the main volume of tidal flow occurs.

An Automatic Pumping Device for Sampling Postlarval Shrimp (*Penaeus* spp.)

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ABSTRACT

*Described is an automatic sampling device used to collect and preserve postlarval shrimp (*Penaeus* spp.). At timed intervals, seawater is pumped through collecting nets which retain samples of organisms including shrimp. A maximum of 12 samples can be collected in 24 hours. Each sample is preserved immediately in 10 percent Formalin. These samples may be removed once after each 24 hours of operation, or they may be accumulated with similar samples over a longer period of time. Comparison is made between catches with the automatic device and those made with the Renfro beam trawl.*

INTRODUCTION

In the early 1960's, studies were initiated to investigate the possibility of predicting brown shrimp (*Penaeus*

aztecus Ives) commercial landings from indices of abundance of postlarval shrimp collected during their movement into Gulf coastal bays (Baxter, 1963). A similar approach has been

used in the same region by other investigators (St. Amant, Corkum, and Broom, 1963; Christmas, Gunter, and Musgrave, 1966; St. Amant, Broom, and Ford, 1966; Baxter and Renfro, 1967; Berry and Baxter, 1969). The samples of postlarvae collected in these investigations were taken with a 1.5-m, hand-drawn beam trawl described by Renfro (1962). Though this device samples postlarval shrimp effectively, it is subject to the limitations that (1) sorting of the samples is time-consuming owing to collection of detritus by the trawl, and (2) sampling must be conducted in shallow water away from the passes in which the main volume of tidal flow occurs. In addition, the sampling operation is often time-consuming and difficult.

The present paper describes an automatic sampling device that was designed to alleviate these problems. This sampler has been tested near Galveston Bay, Texas, for extended periods and has proven to be satisfactory for the collection of small, detritus-free samples from the main tidal flow at frequent intervals.

DESCRIPTION OF GEAR

The automatic sampler consists of a pump, a diesel engine, an electronic control panel, and a turntable equipped with a series of nets for collecting, preserving, and storing samples. Numbers

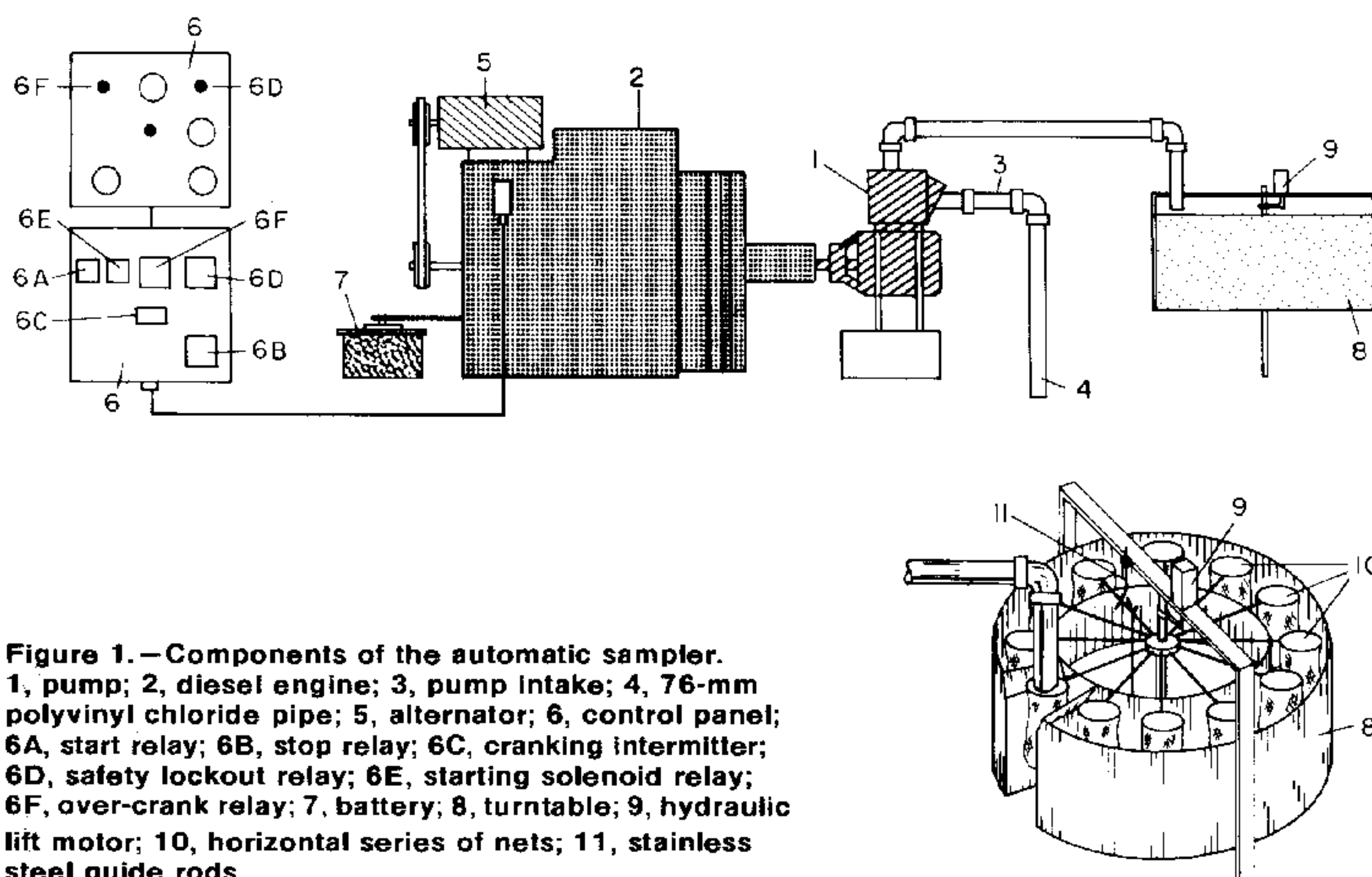


Figure 1.—Components of the automatic sampler. 1, pump; 2, diesel engine; 3, pump intake; 4, 76-mm polyvinyl chloride pipe; 5, alternator; 6, control panel; 6A, start relay; 6B, stop relay; 6C, cranking intermitter; 6D, safety lockout relay; 6E, starting solenoid relay; 6F, over-crank relay; 7, battery; 8, turntable; 9, hydraulic lift motor; 10, horizontal series of nets; 11, stainless steel guide rods.

in parentheses in the text that follows correspond to those used for identification of the components of the sampler in Figure 1.

A Gorman Rupp¹ self-priming, centrifugal type pump (Model 12B2B) equipped with a two-vane ductile iron impeller was used (1). The impeller is designed to handle solids up to 51 mm in diameter without damage; the back of the impeller shroud has pump-out vanes to prevent binding. The pump intake (3) has a 51-mm opening. A flexible rubber hose (0.6 m long) joined to a 76-mm polyvinyl chloride pipe (4) was attached to the intake. A removable end plate provides easy access to the pump interior for quick inspection and maintenance.

A 5¼hp Lister diesel engine (2) was used to drive the pump. This engine provided ample power for both the pump and alternator (5). A light-weight diesel fuel, essential for operation in winter, was used to assure fast starting.

The control panel (6), which was custom-made by Frank W. Murphy Manufacturer, Inc., Houston, Texas, was powered by a heavy-duty, 12-volt, 225 ampere-hour battery (7). The battery was kept fully charged by a 12-volt 85-amp alternator (5) equipped with a voltage regulator (not shown) attached to the diesel engine. The control panel was equipped with start and stop relays (6A and 6B, respectively) set to time the

cycle of operation. These provided delayed switch transfer on energization of the coil and delayed resetting upon coil deenergization. Each delay was independently adjustable. When the start relay (6A) was in the "on" position, it energized the cranking intermitter (6C), which in turn sent current to the starting solenoid relay (6E), the safety lockout relay (6D), and to the starter (not shown) which started the pump. When the pumping cycle was completed, the stop relay (6B) deenergized the panel and stopped the pump.

The control panel was equipped with two safety devices. One was designed to protect the battery by controlling the number of times the starter would be engaged. This device repeated the starting cycle three times. If the engine did not start after the third try, the over-crank relay (6F) tripped a reset button which stopped all current. The other safety device, the safety lockout relay (6D) was a low oil pressure switch. If the engine's oil pressure dropped below normal during operation, the switch activated a reset button which stopped all current. Once the safety switch shut off the system, manual starting was required.

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The turntable (8) for collecting, preserving and storing specimens consisted of a 0.9-m diameter fiberglass tank containing 10 percent Formalin, a hydraulic lift motor (9), and a horizontal series of nets (10). A 152-mm section was cut away from the tank to allow the sampled water to pass through a net and be discarded. Twelve 102-mm rings mounted over the tank were fitted with nets having 1-mm² bar mesh. After each pumping cycle, the turntable rotated, deposited the net containing the fresh sample of the Formalin bath, and positioned the next net over the cutaway to receive the next sample. Turning and positioning of the nets were controlled by a stainless steel guide rod bent at a 45-degree angle over the support rods (11) and by a Y-shaped rod mounted below. As the hydraulic motor lifted the nets, the rods guided them into position.

METHODS

The automatic sampler was tested in the Bolivar Roads Tidal Pass, the major entrance to Galveston Bay, Texas, during 1968-1970. The intake pipe was positioned 1 m below the surface in 4.6 m of water. The device occasionally malfunctioned during initial testing. Most malfunctions were traced to the control panel, but water in the fuel and breakdown of the holding tank and turntable were other causes of malfunction. Before testing was terminated, however, the sampler operated without failure for 120 consecutive days.

RESULTS AND DISCUSSION

To assess the effectiveness of the automatic sampler in capturing post-larval shrimp, a comparison (Figure 2) was made of catches taken with the sampler and with the Renfro beam trawl (unpublished data, K. N. Baxter) at opposite sides of the Bolivar Roads ship channel. The maximum average catch of postlarvae per hour with the automatic sampler was near 5. Catch per tow with the beam trawl was greater than catch per hour with the automatic sampler, and catches with the two types of gear appeared unrelated.

The automatic sampler was operated during all tide stages and over a several-day period in many cases (Figure 2). Since catches collected by the de-

¹ The use of trade names in this publication does not imply endorsement of commercial products.

vice were small, this tended to mask fluctuations in abundance of postlarvae that were measured with the beam trawl. In an earlier study (Baxter, 1965) plankton samples taken at Rollover Pass, Gilchrist, Texas, contained greater numbers of postlarvae during flood tides than during other tide stages. It is believed that catches could be increased by enlarging the intake to the pump and by facing it seaward in the channel. A similar device with a larger intake already has been used successfully by Fontaine et al. (1972). A switch activated by incoming tidal currents also could be added to the sampler to allow its operation only during flood tides.

The automatic sampler could be used to measure diel fluctuations in catch (related to tide stage, time of day, etc.), if the catches in each of the 12 sample bags were removed and examined separately after each 24 hours of operation.

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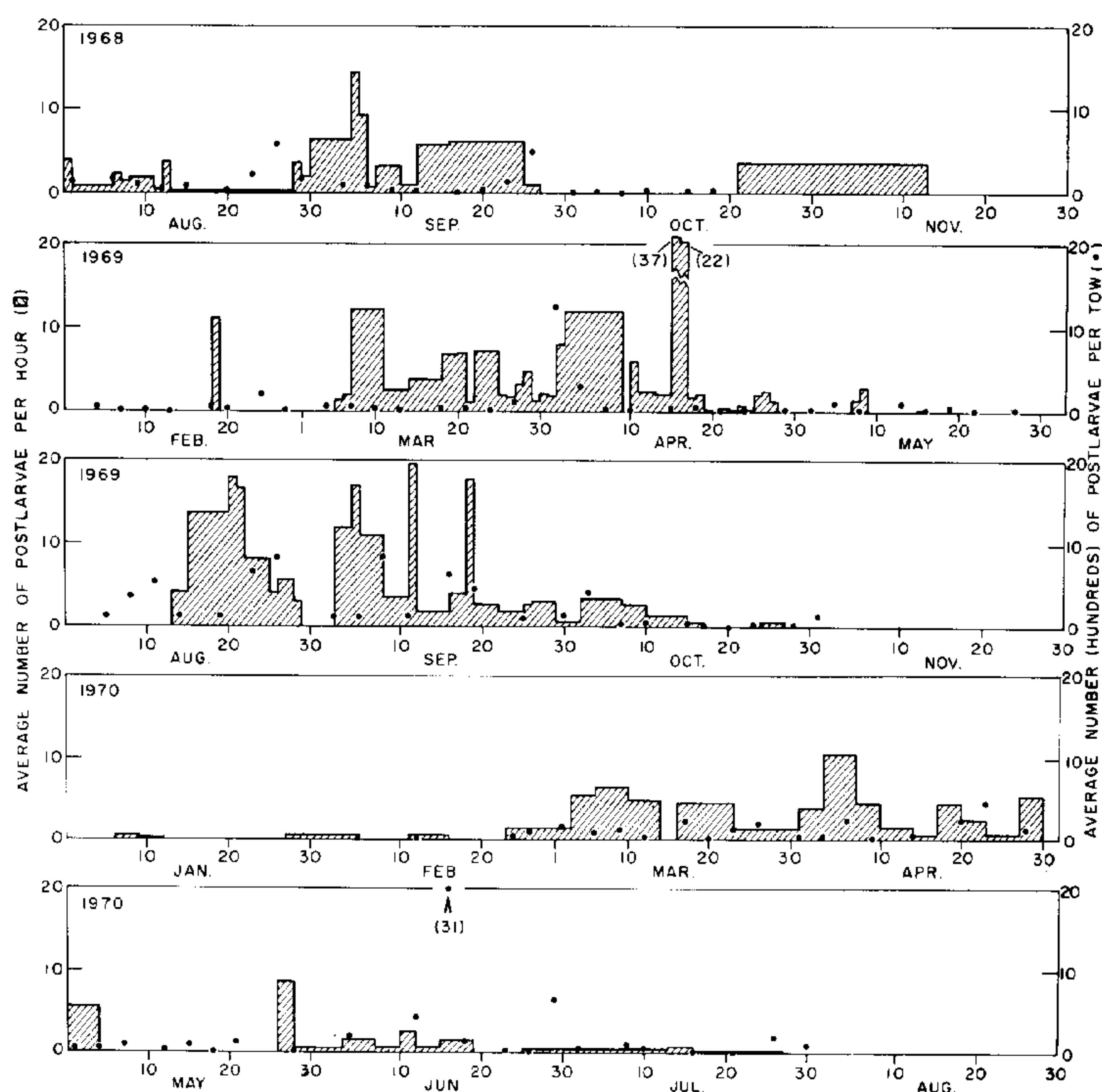


Figure 2. — Catches of postlarvae with the automatic sampler (average number per hour)—shaded —and with the Renfro beam trawl (average number per tow)—black dots.

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